Modal Distance and the Mind Body Problem

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January 2026

Are the mind and the body the same thing? Are the mind and brain identical? Are mental states brain states? Can there be brains without minds, or minds without brains? Over a century of empirical neuroscience research demonstrates that there are no mental states without corresponding brain states—pain, emotion, pleasure, sensory experience, and other mental states all have neural correlates. Neuroscience has thus staked the ontology of the mind and brain with a necessary identity relation: mental states *are* brain states and vice versa, the mind *is* the brain, M=B. *How* brains produce conscious experience is the hardest of all problems, even for neurobiology, but the metaphysical question of what the mind *is*, from a neuro-empirical standpoint, appears settled. Neuroscience implies a materialist answer to the mind-body problem.

However, in *Naming and Necessity* (1980), Saul Kripke is not convinced of this metaphysical nor semantic picture. He asserts on modal grounds that, unlike heat and the molecular motion that gives rise to it, we can imagine mental states occurring *without* corresponding brain states, and so that mind-brain identity isn't a necessary truth. For Kripke, minds and brains are merely *contingently* identical in our world, and

there may be other possible worlds, *qua* counterfactual situations—ways a world might be—in which mind-brain identity does not hold. Did Kripke get mind-brain identity wrong? In this paper, I consider Kripke's refutation of mind-brain identity in context with neurobiological findings and developments in artificial intelligence to argue that although scientific evidence contravenes Kripke's conclusions, speculation about artificial minds gives force to it. To address this tension, I develop a notion of *modal distance* that I argue is useful for contextualizing Kripke's mind-brain non-identity claim with contemporary neuroscientific orthodoxy and speculations about sentience in artificial intelligence systems and non-human organisms that allows differential weighting of metaphysical possibilities depending on the context of inquiry and the suggestions of available evidence. The upshot is that we do not need to necessarily full-throatedly accept nor flat-out deny far out metaphysical possibilities, and can flexibly calibrate our epistemic attitudes toward them as a function of evidence.

Kripke and Mind-Brain Identity

The mind-body problem has puzzled philosophers for centuries. In modern form, the problem traces neatly to Descartes, in whose *Meditations* we find a deep struggle with the nature of the connection between experience and the physical—the mind and the body—and a valiant search for an account of their separateness yet

fundamental intertwinement (Descartes 1641). Contemporary science, on the other hand, has left Descartes in the dust for materialism. For the neuroscientist, mental states and conscious experience *are* brain states. Belief in this metaphysical identity is widespread in science and philosophy, and much empirical research puts significant force behind the high credence with which many endorse physicalism. For many contemporary scientists and philosophers, mind-brain identity is metaphysical truth because empirical science has yet to uncover a conscious mental state in the absence of a corresponding brain state. Although, artificial intelligence, artificial brains, neural organoids, and other 'sentience candidates' (Birch 2024) muddy the waters significantly. (More on this later.)

Saul Kripke was not a physicalist. In *Naming and Necessity*, he addresses the mind-body problem quite quickly and dismisses mind-brain identity, i.e. the proposition that mental states are brain states, as merely contingent in our world, and not a necessary truth in all possible worlds like other necessary identities, e.g. that heat is molecular motion, water is H_2O, and light is a stream of photons. The argument is swift, and comes in the context of Kripke's discussion of natural kinds, in which he argues that while identities in statements expressing scientific discoveries like "gold is matter with atomic number 79" and the other examples above are true in all possible worlds, mind-brain identity is not. Kripke considers the experience of pain, and argues we can imagine there might be pain experience without 'c-fiber stimulation', that is,

neural or brain activity, and therefore that pain is not necessarily identical to c-fiber stimulation, and so that mental states and brain states, *viz.* mind and body, are not necessarily identical.

In reasoning about statements of identity containing natural kind terms like *heat* or *gold*, Kripke contends that their semantics are functionally like those of proper names—they are rigidly designated by an act of pointing or "initial baptism" and propagated by a linguistic community (1980: 96) that anaphorically refers to the designates individual or class (*ibid:* 127). For names, rigid designation is a straightforward act, but less so for natural kinds. We might discover empirically that the nature, essence, or internal structure of a natural kind is different than we supposed in the initial act of pointing that rigidly designated the reference of the term originally used to pick it out by its 'explanandum profile' (Maudlin 1986). The terms fixed may still successfully refer by picking out objects' contingent properties, but there was a mistake on the part of the linguistic (or epistemic) community about the referent's *nature* that is corrected by scientific discovery, the resetting or refining of the reference by experts as appropriate, and a new, recalibrated anaphoric activity within the respective community.

Once the nature of a natural kind is discovered and its semantics definitively settled by science, the *essence* of the kind is, for Kripke, fixed across possible worlds, and identities of the form A=B containing the natural kind term on one side and the essential

or natural properties of it discovered empirically on the other are *rigidified* since the equality is flanked by rigid designators. Such a relation between two rigid designators, $R_1=R_2$, thus expresses a necessary truth, unlike a relation between a rigid designator and a description, $R=D$, which could *disintegrate* in some modal contexts or be rendered contingent by empirical discovery. This occurs if we stipulate a world where, for example, the inventor of bifocals isn't Benjamin Franklin and therefore conclude that it was an accidental, non-essential property of Benjamin Franklin that he was the inventor of bifocals, or if science discovers that a celestial body is not in fact a planet, as occurred with the reclassification of Pluto to a dwarf planet, or planetoid, in 2008.

Disintegration cannot happen to an identity like 'Hesperus is Phosphorus' or 'heat is molecular motion' if the natures of the objects or phenomena are known empirically—if X were not Y, then X and Y would be different things, and the identity statement would be false. For necessary identity, being X *is* being Y, across all worlds and in all contexts. If a substance does not have 79 protons, it is not gold, and never was. If something were not molecular motion, it would not be heat. If a stimulus was not a stream of photons, it was not light. The empirical discovery of the nature of things defines their metaphysics and semantics. Kripke asserts this *modal stability* of necessary truths by empirical discovery of their essences in a passage about the molecular composition of objects:

> "We can imagine having discovered that [an object] wasn't composed of molecules. But once we know that this thing is composed of molecules—that is, the very nature of the substance of which it is made—we can't then, at least if the way I see it is correct, imagine that this thing might have failed to have been composed of molecules." (Kripke 1980: 126-27)

For Kripke, the *reference* of natural kind can be fixed by contingent properties, like in the case of gold being a yellow metal found in the mountains, but its *nature* or *essence* cannot be similarly determined—that is the work of science. When the discovery was made that gold isn't *essentially* a yellow metal but a substance with 79 protons, that property defines its nature—*what it is,* metaphysically. The same goes, by Kripke's lights, for other scientific identities that identify essential properties and so define the semantics of natural kind terms and the modal stability of propositions' truth values or relations containing them, e.g. heat = molecular motion, lightning = electrical discharge, water = H_2O, and so on:

> "When we have discovered [that X is Y], we've discovered an identification which gives us an essential property of this phenomenon. We have discovered a phenomenon which in all possible worlds will be molecular motion [,electrical discharge, H_2O, etc.] because that's what the phenomenon *is.*" (*ibid:* 133).

How we *talk* about these natural kinds might be by referring to their contingent properties, appearances, or how they affect our nervous systems, but what they *are* metaphysically, *their being*, is independent of those sensations, appearances, and utterances, and would be the same if our nervous systems, sensory experiences, or languages were different. It is in this talk of the affectation of the nervous system, experience, and language, and their relation to natures of things that leads Kripke to his modal refutation of the mind-brain identity thesis. He asserts that the identity isn't a necessary truth because we can posit a situation, that is, *stipulate a possible world*, where the identity between mental states and brain states disintegrates.

Kripke argues that while our experience of heat might be contingent on the properties of our nervous systems, heat is identical with molecular motion in all possible worlds. There might be creatures that experience molecular motion as flashes of color or by some other sensory phenomenology like or unlike ours, yet for there to be heat and heat experiences, whatever they might be like, there *must* be molecular motion. We can therefore understand his picture of the relations among the world, experience, thought, and language as such:

Heat case

molecular motion → brain state → heat experience → "heat" thought, utterance

In the heat case, the sentence "heat is molecular motion" and the proposition heat = molecular motion is true in all worlds. Thus, □(heat = molecular motion)[1] and "heat" necessarily refers to molecular motion independently of the phenomenology it produces. Not so, thinks Kripke, for pain experience. Kripke reasons that while molecular motion gives rise to the sensation of heat, pain does not work this way—there is no necessary independent underlying physical phenomenon like molecular motion giving rise to pain experience. Rather, pain experience, for Kripke, is an internal phenomenon that might occur independently of 'c-fiber stimulation' or the requisite neural activity required to elicit the experience of pain. This picture would be:

Pain case

stimulus → c-fiber stimulation → pain experience → "pain" thought, utterance

(brain state)

In this case "pain" doesn't, for Kripke, necessarily refer to a brain state like "heat" refers to molecular motion. Rather, "pain" refers to a sensation that might be *multiply realizable* (Putnam 1967) via different physical phenomena. Unlike the heat case, for Kripke, there

[1] Hereafter, I will occasionally use shorthand that binds the necessity operator to the equality with a subscript and express "is necessarily identical to" with $=_{\Box}$ (e.g. A $=_{\Box}$ B), and "is not necessarily identical to" with $\neq_{\Box}$ (e.g. A $\neq_{\Box}$ B).

is no equivalent to molecular motion that necessarily stimulates c-fibers nor are c-fibers necessary for pain experience in all possible worlds, so he can imagine pain occurring without it. Kripke thus concludes that pain $\neq_{\Box}$ c-fiber stimulation, and therefore that mental states $\neq_{\Box}$ brain states, and that mind-brain identity is false. Necessary identification of brain states and mental states does not hold for Kripke because he can imagine one occurring without the other, and so that the *nature* of mental states is not that they are *essentially* brain states, and vice versa. The conclusion is rebellious, but does it hold up to contemporary scientific understanding of the mind and brain?

Experience and Neuroscience

One's pain experience, and other conscious, sensory experiences for that matter, are subjective and beyond the limits of objectivity (Nagel 1974). They are *private.* Obviously, we can report them, but they are inaccessible to others until we do, and even then, are transposed into variably accurate language. Further, many variations of physical phenomena that might produce the relevant nervous system activity that give rise to a sensation of pain, color, or any other perceptual experience (Clark 2000: 15). However, for Kripke, experience isn't necessarily connected to its neural correlates. In agreement with all physicists, Kripke cannot imagine heat being anything other than molecular motion, but, against most neuroscientists, he can imagine a pain or other

experience arising from something other than the brain state and neural activity associated with it. Therefore, on modal grounds, Kripke asserts that pain is not necessarily identical to 'c-fiber stimulation' and so that mental states are not necessarily brain states, that experiences aren't identical with neural activity, and therefore that mind-brain identity is contingent in our world, and *not* a metaphysical necessity.

Kripke's view flies in the face of neuroscientific dogma, by which every experience necessarily has a corresponding neural or brain state. For the neuroscientist, mind-brain identity *is* a necessary truth—there cannot be any experiences without the requisite neural activity to produce them. Mental states *are* brain states on the orthodox neuroscientific view, and a neuroscientist could likely *not* imagine a scenario like Kripke's possible world in which mental states occur independently of brain states. The neuroscientist, I think, could likewise not conceive of a philosophical zombie (Chalmers 1996) that was like us in every way except that it does not have mental states, and would likely dismiss imaginings like this as metaphysical impossibilities or mere philosopher's play.

The neurological evidence against Kripke is strong. Two neurological conditions, congenital insensitivity to pain (CIP) and pain asymbolia, provide forceful rejoinders to his argument as cases of micro- and macro-level brain changes, respectively, that inhibit neural circuits associated with nociception and result in loss of pain experience. In CIP, patients seemingly feel no pain when exposed to painful stimuli. CIP can result from

several genetic abnormalities, but one common mutation is in the *SCN9A* gene (Cox 2006, Medline 2025). *SCN9A* encodes proteins responsible for structural aspects of nociceptors (neurons that transduce pain signals), specifically sodium-gated ion channels whose proper function is required for the propagation of chemo-electric action potentials, and so for pain perception. *SCN9A* alterations have also been discovered to be involved in human genetic neuropathic pain disorders (Drissi 2020, Medline 2025) where patients feel pain without painful stimuli or injury because they have baseline nociceptor activation. Patients with CIP have no pain experience because they have molecular level defects in the sensory transduction pathways in the brain that produce pain experience. These patients do not have the requisite brain states for pain experience, and so do not have pain experiences. In CIP, mind-brain identity holds.

In pain asymbolia or pain dissociation, patients do not experience pain as unpleasant or have unusual reactions to pain stimuli, including atypical emotional reactions or verbal reporting (Griffith and Kind 2023). Pain-asymbolic patients also experience a depersonalization and disconnection from pain in which they report it lacks its typical "mineness" and does not feel like it's happening to them (Garrens 2020). Neurological causes of asymbolia include damage to the insular cortex, which is responsible for integrating sensation, emotion, and consciousness, and/or the limbic system, which is responsible for basic emotions like fear and pleasure and basic drives like hunger, that result from stroke, brain injury, or surgery that impairs, disrupts, or

removes the neural tissue required for pain perception. Pain asymbolia also demonstrates a clear case in which a lack of brain states that process pain signals results in a lack of conscious pain experience.

In both CIP and pain asymbolia, there is no pain without the requisite brain tissue, neural circuits, or molecular machinery that mediates signal transduction, and therefore there are no mental states or experiences of pain without the relevant brain states, and vice versa. These neurobiological cases are direct counterexamples to Kripke's claim that we can imagine pain experiences without brain states correlated with pain, or the general claim that brain states and mental states are not necessarily identical. The empirical neuroscientific evidence strictly implies mind-brain identity.

Seemingly, there are no known cases of the kinds that Kripke imagines where mental states and brain states come apart. All cases of pain experience or lack thereof are explainable neurologically. Kripke's assertion that such cases are conceivable identifies a metaphysical possibility that we might discover, but haven't yet—and don't expect to. The empirical evidence counters Kripke's resistance to mind-brain identity. Neuroscience has no cases, at least in humans, that support his assertion that experience can metaphysically dissociate from brain states. Were his intuitions plainly wrong? In what follows, I develop some epistemological strategies for dealing with metaphysical possibilities that suggest he wasn't necessarily, and argue that while there might be decent reasons to remain open about the non-rigidity of mind-brain identity.

Conceivability and Modal Distance

Kripke makes a *conceivability* argument against materialism about the mind and body by imagining a counterfactual situation in which experiences occur without the associated neural activity that neuroscience typically observes co-occurring with mental events. The difficulty with this type of argument is that it is possible to conceive of impossible things or 'phenomenal deviants', as Hobbes imagined himself as having squared the circle, or how 16th century chemists imagined water as being the hydroxyl radical (HO) rather than dihydrogen monoxide H_2O (Pelczar 2021). Are these genuine imaginings of things that could be true, or are they mistakes?

In these cases, especially the latter, they look like mistakes. The chemists imagined that it might be the case, *it could be*, that water was composed of hydrogen and oxygen, i.e. $\Diamond$(water = HO), but it never was. Their *modal imagining* (Chalmers 2002) was trumped by Cavendish's discovery that water was H_2O and Lavoisier's confirmation in the early 1780s. Imagining $\Diamond$(water = HO) after those events would be epistemically irresponsible and metaphysically inaccurate. In fact, it was metaphysically inaccurate the entire time. Hobbes, as much as he might imagine, never produced any evidence, nor could, that the circle had been squared, and von Lindemann showed it impossible by proving that π is a transcendental number (not the root of any simple polynomial) in 1882. These imaginings, though genuine imaginings *before the relevant empirical*

discoveries, turned out to be, in fact, impossibilities. Just as we could not imagine heat being anything other than molecular motion, we cannot really imagine water not being H_2O or the circle being squared, though we might choose to, foolishly given the evidence, believe that these propositions are genuinely possible. Can we truly imagine minds without brains as a metaphysical possibility when the empirical neurobiological evidence says exactly otherwise?

One way of reading Kripke's position is to take perception as telling us about actuality and presenting what is true, and imagination as telling us about metaphysical possibility and presenting what is possible (Kung 2016). On this interpretation, whatever we imagine, be it squared circles, time travel, or philosophical zombies, is metaphysically possible. The imagining of a metaphysical possibility entails nothing about its truth, especially taking possible worlds, as Kripke does, as stipulated counterfactual situations or *abstractions* of how a world might be in some respects or others used as heuristic device with explanatory force shaped by the facts and norms of the actual world (Stalnaker 2003: 25-26), and not given, "purely qualitatively, as if we are looking at them through a telescope" (Kripke 1980: 50, cf. 44-53). What we do when we imagine something in the way that Kripke imagines mental states without brain states is consider the possibility of a proposition. In this case *that mental states are distinct from brain states*, or, formalized, that there could be a mental state that is not a brain state: $\Diamond(\exists x)(M_x \neq B_x)$.

If we think in terms of propositions and about Kripke's modal arguments, we might think that imaginability is a guide to possibility (Byrne 2007). Thinking in terms of propositions then, an imagining has at least two aspects. One is the construction of the proposition (Kung 2016), and the other is our attitude toward it—entertaining, assuming, supposing, thinking, and so on (Byrne 2007). The truth value of the proposition *P* is another matter entirely and depends on modal context. The proposition might be true in some worlds *qua* counterfactual situations and false in others, unless there is empirical evidence that establishes modal necessity. We can consider the proposition in the actual world, possible worlds, a subset of possible worlds, or all worlds, and *modally imagine* it "as a configuration of objects and properties" (Chalmers 2002) that make *P* true.

This modal layer of our considering the proposition determines how we might view its content. If we consider what it takes to take the proposition that heat (H) *isn't* molecular motion (MM) into a possible world and have it be true, the world we would need is abjectly strange. For H≠MM to be true, the truthmaking world would have to have such drastically different physical laws than the ones that have been discovered, and the interactions and behavior of matter would not be what they are that these worlds are in some sense inconceivable. Perhaps brilliant physicists could do the relevant imagining, but for our purposes it is enough to say that this counterfactual situation is a *distant world.* It is logically, metaphysically, physically, and imaginatively

far from many other worlds in between it and the actual world, $w_@$, that we might posit.[2] We might say that this world w_z is so distant that it renders the metaphysical identity proposition H≠MM effectively false, and that, epistemically, we ought to assign a zero probability to its being true, and have an extraordinarily low credence or degree of belief that it might be true in $w_@$ and many intervening worlds $w_b \ldots w_y$. However, at logical steps through those intervening worlds within the *world space*, our credence might be warranted to increase given the conditions, context, and evidence that might be found in those worlds. That is, degrees of belief might change as a function of modal distance and the characteristics of possible worlds in a systematic way.

The concept of modal distance can also help us evaluate Kripke's refutation of mind-brain identity. In Kripke's case, he believes (B operator) it is possible (◇) that there exists (∃x) a mental state that isn't a brain state, or $B(\Diamond(\exists x)(M_x \neq B_x))$, or B(K) for short hereafter. This seems to be false given the context of the actual world and the evidence produced by neuroscience about human experience and brain function. So, we might formalize that the probability (P) of minds not being identical to brains (K) given neuroscientific evidence (E_n) as $P(K|E)$ and is quite near zero in the actual world $w_@$, and some, if not many scientists and philosophers would assign it a probability of zero.

[2] The use of the subscript notation is to formalize the concept of modal distance. If $w_@$ is the actual world, then worlds with subscripts leading down the alphabet are increasingly more distant. The letters are a convenience to capture the magnitude (*z* is further from @ than *b*), and large distances could be represented with numbers ($w_1, w_2 \ldots w_n$), differences in kind with symbols ($w_\delta, w_\gamma, w_\theta$), and maximally distant worlds by an infinity subscript (w_∞) such that a *world space* ranges from $w_@$ to w_∞.

We might therefore have low credence in Kripke's proposition that mental states are not necessarily identical to brain states.

Is Kripke's non-identity proposition only believable distant worlds? If we expand the context, *K* can look reasonably possible in the actual and near possible worlds without disrupting any fundamental natural laws. Recent speculation about artificial intelligence questions whether artificial systems like large language models have the capacity for sentience or consciousness (Chalmers 2023), and other thinking speculates that our prioritizing computational roles or biological realizers favors consciousness in artificial intelligence or simpler animals, respectively (Block 2025). And still more thinking questions what kinds of things are 'sentience candidates', and some of them may not have fully fledged human-like brains, as in the cases of invertebrates, fetuses, or human organoids, or don't have brains at all as in the case of artificial intelligence, but could have 'valenced experiences' like pain and pleasure (Birch 2024).

Expanding the body of evidence to consider in this way changes the way we might consider proposition K. If we do not have definitive empirical evidence that things without brains do not have experiences, then we can't rule out Kripke's modal assertion that experiences and brain states may come apart. Further, if we stipulate a future state of the actual world, that is, a near possible world, where neuroscience and artificial intelligence have solved some key problems, we would *know* if the proposition was true. Unlike finding worlds where heat and molecular motion come apart, we must

travel far less modal distance to find worlds where Kripke's refutation of mind-brain identity might be true, or at least supported by some scientific finding about artificial intelligence systems or non-human sentience candidates.

Epistemic Humility

If we consider Kripke's refutation of mind-brain identity in a context constrained by human neurobiology, then it not only looks false, but it might be a metaphysical impossibility of a maximally distant world. However, when we *open up* the context to include what we might discover empirically about non-human animals, synthetic entities with neurons, artificial intelligences, fetuses, or other sentience candidates in the actual world or in very near possible ones where science is further advanced, his proposition takes on a different character. In one context, we assign little probability to a proposition being true and would give it minimal credence because what is considered "given" as evidence (B) in P(A|B) is too tightly constrained. The *context window* is too small for us to see the ways in which the proposition might be true—too narrow for us to consider that an assumed necessary metaphysical truth might be merely contingent. Too much contextual constraint blocks us from seeing the ways in which a proposition might be true, and so puts downward pressure on the credence we might have in it. This downward pressure from narrow perspective can distort our

epistemic attitudes toward what could be knowable metaphysical truth, or a possible scientific discovery that generates new hypotheses for empirical projects.

What then of conceivability and possibility, and Kripke? Kripke's modal strategy against mind-brain identity takes advantage of modal imagining and possible worlds to highlight a far out possibility that minds aren't brains whose actuality is challenged by empirical neuroscience, but as I have argued, kept modally open by non-human sentience candidates. Kripke's modal refutation of mind-brain identity is logically sound, however its force depends on the empirical context within which one considers it—it is undermined by human neurobiology but epistemically open in the context of a wider conception of sentience.

Modal arguments reveal possible situations to us. That is all they ask us to do—to attempt to imagine things being the case, to imagine the world being a certain way, to posit what the existential quantifier might quantify over. Some of the stipulations such arguments make might strike us as metaphysically possible, yet epistemically distant, like a world in which heat is not molecular motion, or that Richard Nixon was a ham sandwich. Some might be closer, like a world in which Obama lost the 2008 U.S. presidential election, or Bernie Sanders was the 45th commander-in-chief. Some might appear distant but be nearer than we think, like those with inverted spectrants or conscious artificial intelligence, or appear near but are quite distant, like those with philosophical zombies. How distant a world is can guide us to the level of credence we

might have in its propositions being true in the actual world. Modal distance is a sliding scale by which we might *calibrate* our attitudes about the truth or falsity of propositions we encounter and meet them with cognitive openness and epistemic humility, especially those like Kripke's denial of mind-brain identity that might seem like unbelievable, unorthodox positions at first blush.

References

Birch, Jonathan (2024). *The Edge of Sentience.* Oxford University Press, Oxford.

Block, Ned (2025). "Can Only Meat Machines Be Conscious?" *Trends in Cognitive Sciences* October 7, 2025.

Byrne, Alex (2007). "Possibility and Imagination" *Philosophical Perspectives* 21: 125-144.

Chalmers, David J. (1996). *The Conscious Mind: In Search of a Fundamental Theory.* Oxford University Press, New York.

Chalmers, David J. (2002). "Does Conceivability Entail Possibility?" In *Conceivability and Possibility,* ed. T. S. Gendler and J. Hawthorne. Oxford University Press, Oxford.

Chalmers, David J. (2023). "Could a Large Language Model Be Conscious?" *Boston Review* August 9, 2023, presented at the conference on Neural Information Processing Systems (NeurIPS) on November 28, 2022.

Clark, Austen (2000). *A Theory of Sentience.* Oxford University Press.

Cox J. J., Reimann F., Nicholas A.K., et al. (2006). "An SCN9A channelopathy causes congenital inability to experience pain" *Nature* 14 444(7121): 894-898.

Descartes, René (1641/1984). *Meditations on First Philosophy.* In *The Philosophical Writings of Descartes,* ed. J. Cottingham, R. Stoorthoff, and D. Murdoch. Cambridge University Press, Cambridge.

Drissi I., Woods W. A., Woods C. G. (2020). "Understanding the genetic basis of congenital insensitivity to pain" British Medical Bulletin 133 (1): 65-78.

Gerrans, Philip (2020). "Pain Asymbolia as Depersonalization for Pain Experience: An Interoceptive Active Inference Account" *Frontiers in Psychology* 11.

Griffith, Trevor and Kind, Adrian (2023). "Pain Asymbolia is Not Pain" *Philosophy of Science* 91 (3): 561-578.

Kripke, Saul A. (1980). *Naming and Necessity.* Basil Blackwell, Oxford.

Kung, Peter (2016). "You Really Do Imagine It: Against Error Theories of Imagination" *Noûs* 50 (1): 90-120.

Maudlin, Tim W. E. (1986). "Reasonable Essentialism and Natural Kinds" Doctoral Dissertation. University of Pittsburgh Faculty of Arts and Sciences.

Medline Plus (2025). "Channelopathy-associated congenital insensitivity to pain".

Medline Plus (2025). "SCN9A Gene: sodium voltage-gated channel alpha subunit 9".

Nagel, Thomas (1974). What Is It Like to Be a Bat. *Philosophical Review* 83 (4): 435–450.

Pelczar, Michael (2021). "Modal Arguments Against Materialism" *Noûs* 55: 426-444.

Stalnaker, Robert C. (2003) "Possible Worlds (1976/1984)" In *Ways a World Might Be: Metaphysical and Anti-Metaphysical Essays.* Oxford University Press, Oxford.